WHY AND WHERE

OIL

IS FOUND

By J. C. YANCEY

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AUG -7 1919

no 1

Why and Where

Oil is Found

By J. C. Yancey

In the early days of the oil industry search for new fields was carried on in a haphazard way. Few or none knew exactly where to look for petroleum pools, and none knew why, and it was usually by persistent drilling of wells, and "fool's luck" that prospectors, commonly referred to as wild-catters, made their strikes. Vastly more failures than successes resulted from this unmethodical procedure, and fortunes were sunk in testing hopelessly dry or only slightly productive territory.

Then came science to aid the seekers of this liquid gold, and the geologist was called upon as counsellor and guide. The real prospector had admitted that he knew not "Why and Where."

Said the ancient Arab wise man, "He who knows not and knows that he knows not, is simple — teach him."

So, Man of Science who knows the story of the Dinosaur, who looks down the ages and beholds the battle to the death of Icthysaur and Plesiosaur, who reads from rocks the life romance of Pterodactyl, and knows how crawling reptiles got their feathered wings — be patient with what may seem prolix to you.

Man of the six day week of business, toil and recreation, whose world is one of every day plain fact, to whom the Latin and Greek words of Geologic Science have the sound of myth and legend, be patient if a few strange words appear, for has not Science always camouflaged the simple truths of nature

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with a mystic cloak of magic words familiar only to the initiated, the sacred, secret circle of the Professional World?

But some have told the secrets of the Lodge, and Science now days walks in step with ranks of toil to do the simple tasks of life.

Not twenty years ago Joseph Le Conte, in his "Elements of Geology," said, "I am unable to account for the accumulation of oil as at Baku and Trinidad," thus proving that at that time the geological world was absolutely ignorant of why oil accumulated in any one particular place, and they set about to ascertain *why*.

Today the judgment and advice of the real geologist are indispensable prerequisites to the exploitation of any oil region. The geologist, the driller, the man of capital and the old school oil operator — at least the vast majority of them — now work together side by side. So, with the help that all of these can give, let the question be answered — "Why and Where is Oil Found?"

WHY

Said Dana, Father of Geologic Science, in a lecture when interrupted by a question from one of his students, "Young man, Geologic Time is long, long, LONG — DAMNED LONG!" Dana was a man of master intellect and profound learning, all-be-it deeply religious. Perhaps no words could better give a slight idea of the vastness of these ages than such words from such a man. Nature's process is a slow one. She snaps her finger at time. A million years is to Her what a second is to us.

Let us begin at a time when practically all of the United States was a granite sea floor with the sedimentary rocks yet to be builded in layers (strata).

Let us look back down the dim vastness of those ages where

using years to measure time is like taking the dimensions of atoms to sound the distance to the stars.

The Cambrian Time's dim vastness had ended on the earth. Creation had begun. Life's teeming myriad simplest forms swarmed in the Tropic Sea — the only forms of life then existing. The land was clothed with forest. Dense glades of tropic jungle shaded the moist warm ground. The crowded denizons of ocean changed in form and mode of life, lived both on shore and shoal and then chose the shore; then, driven by Nature's Great Unchanging Law — the *Law of Constant Change* — moved on in changing forms and changing mode of life, filled the dense glades of forest with strange forms, grew wings and flew. The sea, the land, the air — all teemed and swarmed with life.

The Paleozoic Age had come. The Carboniferous Era dawned on earth. Shell life, destined to contribute to the petroleum produced today, had never been so abundant as it was in earliest Carboniferous Times (known today as the Mississippian series of rocks). The time of COAL and OIL began. The curtain rose on the first act of a great drama of the ages. Its theme was COAL and OIL.

Because the now famous North-Central Texas Oil Fields are uppermost in the minds of the public, that area will be used as an example in this article.

In that day North Texas was a sea floor. The Gulf reached north to Hudson Bay. The great Gulf Stream flowed through from Tropics to the Pole, between land masses on the east and west.

How may man know the story of that age? Can human intellect fathom the mystery of that vast dim era? Who lived to see and tell the tale?

The Hand of Science points and Science speaks: "Is not the story written in the rocks? Are not the very stones

beneath your feet leaves in the book? Are not its characters and words the very forms and frames of living things that flourished in that day? Now turned to stone, they write the story in the rocks that 'He who runs may read.' "

The sea floor slowly sank and rose. The land sank and rose again. The sun shone warm, winds blew and rains poured down. The forest trees grew on the swamps and shore; their leaves, their trunks and branches turned to peat and then to coal.

The winding rivers carried down from land to sea their load of sand and soil and with it remnants of earth's life. The sea life lived and reproduced its kind and died in endless changing generations.

Waste remnants of earth's life came down to sea in sand and soil and mingled with the products of the ocean. These animals and plants of land and sea at death became entombed on the sea floor in silt and mud that changed to rock.

The sea floor sank and deposition still went on till tier on tier of sand and soil built up and slowly hardened into stone, charged with life's remnants from the land and sea. The corrals lived and built their reefs of lime. The shell life (mollusk) yielded up its lime to make more stone. The body of the mollusk mingled with life's other remnants in the mud and sand that turned to rock.

From these living things of land and sea Nature distilled the OIL.

WHERE

The sea floor rose and sank and then rose again and took its present form of land.

The geologist would tell, in language understandable only to Men of Science, of the successive stages of submergence,

Map No. 1

Made in 1914, showing the Burkburnett Oil Field which has since been proved by the drill, and other domes which are now being tested; also showing the Electra Oil Field and Petrolia Oil and Gas Field which at that time were producing. This map was prepared from data compiled by Yancey's geological staff in 1913–1914. It is the only map of its kind in existence. The drill has proved the correctness of the theory at that time.

This map shows the surface distorted, which is merely to present more clearly to the layman's mind the idea of these arches and domes in subsurface structure. Surface high structure sometimes indicates subsurface high structure, though not always. For example, the Duke well (See Map No. 2) was drilled on surface low but structural high. One can plainly see that the Trinity sand feathering out at the Cosden gasser (see Map 2), at one time, before it was washed away, arched over the Duke and adjoining wells and reflected the arching of the structure below.

WHERE OIL SHOULD BE
DEVOL ANTICLINAL WORKED OUT BY U.S. GEOLOGICAL SURVEY
RED RIVER
FT WORTH & DENVER R.R.
ONE OF THE BEST OIL FIELDS PRODUCING FROM PENNSYLVANIAN ROCKS
ELECTRA OIL FIELD
SALT WATER
OIL IN STRATA
OIL IN STRATA
BURKBURNETT OIL FIELD
SALT WATER
ELECTRA-BURKBURNETT-FREBERG-PETROLIA
FREBERG
IOWA PARK
BIG WICHITA RIVER
WICHITA FALLS
WICHITA LAKE
JOLLY
F.W.&D.C.R.R.
WICHITA VALLEY R.R.
HENRIETTA
MANKINS
DUNDEE
DUNDEE MANKINS ANTICLINAL WORKED OUT BY U.C. YANCEY'S GEOLOGICAL STAFF MARCH 1918
WHERE GAS SHOULD BE
OIL
OIL
SALT WATER
WHERE OIL & GAS SHOULD BE
LITTLE WICHITA RIVER
RED RIVER
OKER RED RUN
CACHE CR.
OIL IN STRATA
SALT WATER
PETROLIA OIL AND GAS FIELD
SALT WATER
OIL IN STRATA
GAS
THE PETROLIA DOME SUPPLIES THE NATURAL GAS TO DALLAS FT. WORTH AND OTHER CITIES
F.W.&D.C.R.R.
HEALDON FIELD
DISCOVERED IN FEB. 1914 WELLS PRODUCE 1000 BARRELS PER DAY AT 1000 FEET
OIL IN STRATA
SALT WATER
TERRAL TERRY
SALT WATER
WHERE OIL SHOULD BE
NOCONA ANTICLINE WORKED OUT BY J.C. YANCEY'S GEOLOGICAL STAFF JUNE 1918
BELCHERVILLE
NOCONA
SALT WATER
WHERE OIL SHOULD BE
BELCHERVILLE ANTICLINE WORKED OUT BY J.C. YANCEY'S GEOLOGICAL STAFF MAY 1918
SALT WATER
MONTAGUE
BOWIE
F.W.&D.C.R.R.
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emergence, deposition and erosion from Pre-Cambrian time down to the present; of how the Mississippian series of rocks were laid down, the Pennsylvanian and the Permian; of the overlapping and conformity of the various series of rocks; of their arching or folding from the unequal pressure of the uplifting force in the earth's movements; of how the oldest exposed rocks in a given territory are of the Ordivician Age while the youngest are upper Cretaceous. They would tell of the rocks of the Devonian Age, and those classified as Jurassic and Triassic. They would go into detailed description of the color and composition of the various series of rocks and the conformity or non-conformity of the various strata. In the North Central Texas Field they would describe in detail what is called the **Bend** formation, the **Smithwick** and the **Strawn** (the three lower members of the Mississippian which is the lower member of the Carboniferous), their composition, etc. Since the purpose of this article is to attempt to bridge from the scientific to the layman's mind the origin and the theory of oil and to so explain it that all can understand, such descriptions, so far as possible, will be omitted.

These successive stages of submergence, emergence, deposition and erosion have taken place throughout the whole range of geologic time.

The rocks as formed were laid down in level tiers (strata) on the sea floor, and in the earth's movements these tiers were pushed up into arches or folds through the unequal stress of the uplifting force. The crest of these arches are called domes.

The porous rocks laid down beneath the sea were full of brine having an upward tendency from pressure of overlying strata. The oil distilled from animal and plant life of land and sea floated up and up on this salt water in these porous

rocks, for oil is lighter than water and oil and water will not mix.

Through porous rocks of sand and lime oil kept on floating up, filtered into these arches till it reached non-porous rock through which it could not pass, and then moved on to the crest of the arches or the domes. There it gathered in pools from miles around into the highest part (the dome) of this arching (called anticlinal structure) where impervious cap rock safely sealed it in. The troughs (synclines as they are called) were left filled with brine and free from oil which had thus moved to higher levels. This accounts for the accumulation of oil in pools.

Such an arch is the Ranger Field of Texas, where the oil is found in the two lower members of the Mississippian rocks at a depth of 3,250 to 4,000 feet. Such an arch is the now famed Duke Field in Texas, where the oil is found at from 2,600 to 2,800 feet. Such an arch is the famous Burkburnett field of Texas, where the oil has broken through the arch in the original rocks, which cracked in their folding, and has migrated up from approximately 5,500 feet below and is found at from 1,600 to 1,800 feet. Such an arch is practically every field in the world.

Sometimes the arch is plainly reflected and easily discernible on the surface. Sometimes so slightly shown by surface rocks that only a galaxy of trained geologists can, within any reasonable time, determine it by survey or by a series of shallow wells by a diamond drill. Sometimes it is so completely hidden by non-conforming strata that not even Science can determine it at the surface.

The length and breadth of any oil field or pool, and the volume of oil there accumulated, is dependent mainly on the area of drainage. If these arches or folds in the oil-bearing rocks are close together then, of course, the size of the field

Map No. 2

DUKE FIELD
AND
STEPHENVILLE DISTRICT

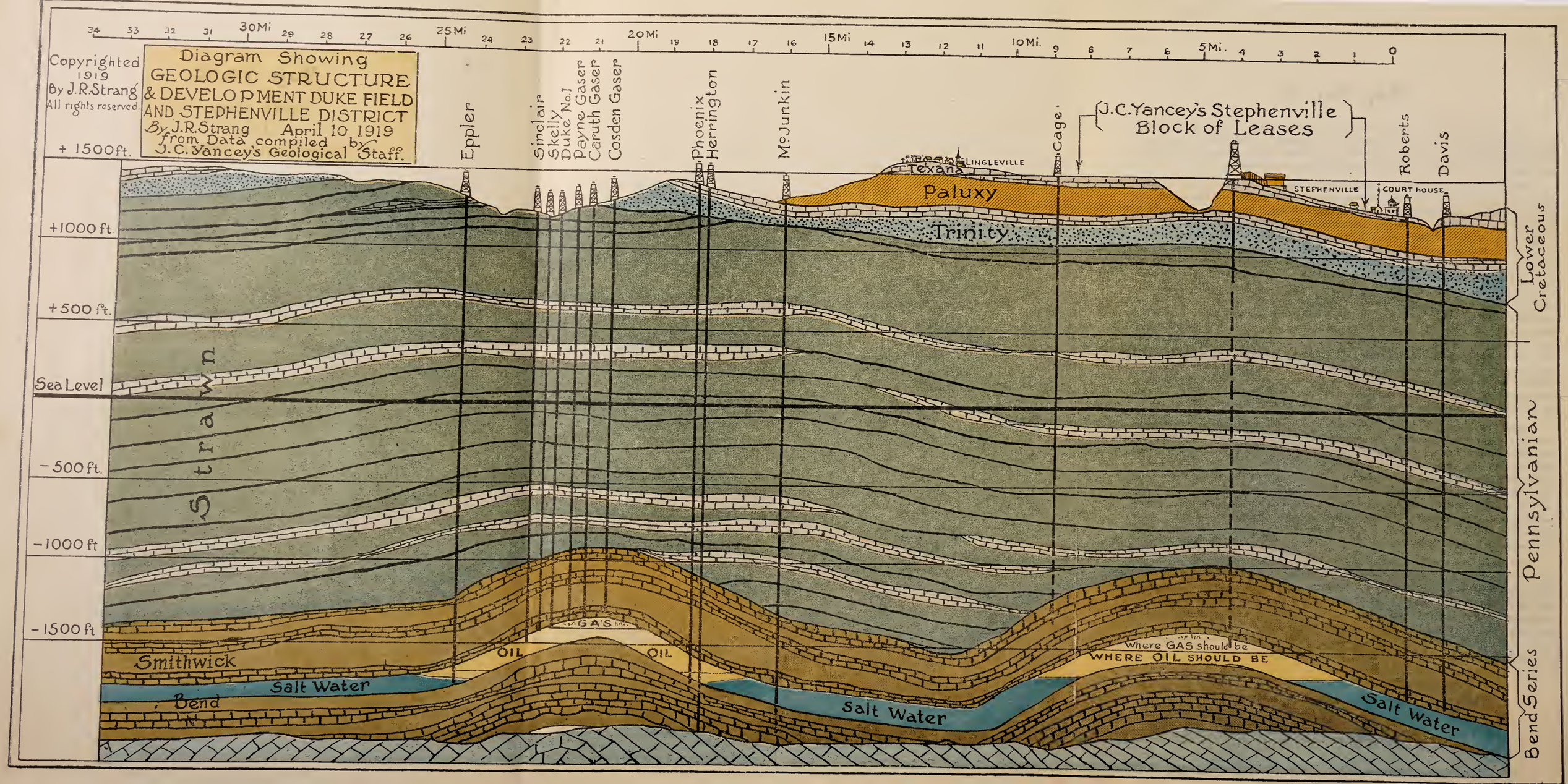
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Diagram Showing GEOLOGIC STRUCTURE & DEVELOPMENT DUKE FIELD AND STEPHENVILLE DISTRICT
By J.R.Strang April 10 1919
from Data compiled by J.C.Yancey's Geological Staff.
34 33 32 31 30Mi 29 28 27 26 25Mi 24 23 22 21 20Mi 19 18 17 16 15Mi 14 13 12 11 10Mi. 9 8 7 6 5Mi. 4 3 2 1 0
+1500ft.
+1000 ft.
+500 ft.
Sea Level
-500 ft.
-1000 ft
-1500 ft
Eppler
Sinclair Skelly Duke No.1
Payne Gaser
Caruth Gaser
Cosden Gaser
Phoenix Herrington
McJunkin
Cage
J.C.Yancey's Stephenville Block of Leases
Roberts
Davis
Texana
LINGLEVILLE
STEPHENVILLE
COURT HOUSE
Paluxy
Trinity
Strawn
GAS
OIL
OIL
Smithwick
Bend
Salt Water
Salt Water
Salt Water
Where GAS should be
WHERE OIL SHOULD BE
Lower Cretaceous
Pennsylvanian
Bend Series

will not be as great as if these arches or folds were farther apart with a greater area from which the oil in the rocks could drain up their monoclines into the dome of the arch.

IMPORTANCE OF GEOLOGIC SCIENCE

The pursuit of oil in new territory, though still attended with risk and a degree of uncertainty, has been made, through the untiring efforts of the Men of Science, far less a matter of guesswork and chance and loss. Of course, the geologist cannot see all that the earth hides in its bosom, but from his knowledge and study of the earth's formation — the various strata — (such knowledge being acquired by actual surveys made and from the study of the logs of wells drilled in oil districts), and the surface indications he can locate what is termed the "structurally high" territory (anticlines) and the "structurally low" territory (synclines), give the general direction of the slopes (monoclines), and determine whether underlying strata on any given tract is reachable by the drill and may be probed with possibilities of an oil yield.

There are two branches of the oil geologist's work — surface and subsurface. The surface geologist studies the outcroppings of rocks (which are rocks at points where the granite has upheaved through these flat-lying sea rocks and stood them on end) to find beds of carbonaceous shales and limestone which may often, as they do at the Llano-Burnett Uplift in Llano, San Saba and Mason counties in the North Central Texas Fields, distill petroleum at the croppings (which however is mostly wasted from long exposure) and show a source of oil. He examines these outcroppings to discover sandstones or fractured limestones capped by impervious beds, that would form reservoirs for oil and gas. He also seeks for surface indications that this oil and gas has localized into pools away from the croppings. The subsurface geologist, from examination and study of these out-croppings,

estimates a safe distance from the croppings where the rocks should be unbroken but are pushed up gently into an arch, or anticlinal fold, and selects and maps the highest part of that fold as a suitable place to drill.

Oil-bearing formations manifest themselves often by surface indications such as gas springs, oil or asphalt seepages. Certain type structures favor the accumulation of oil into pools such as anticlinal domes, and many times there can be most accurate forecasts of drilling results.

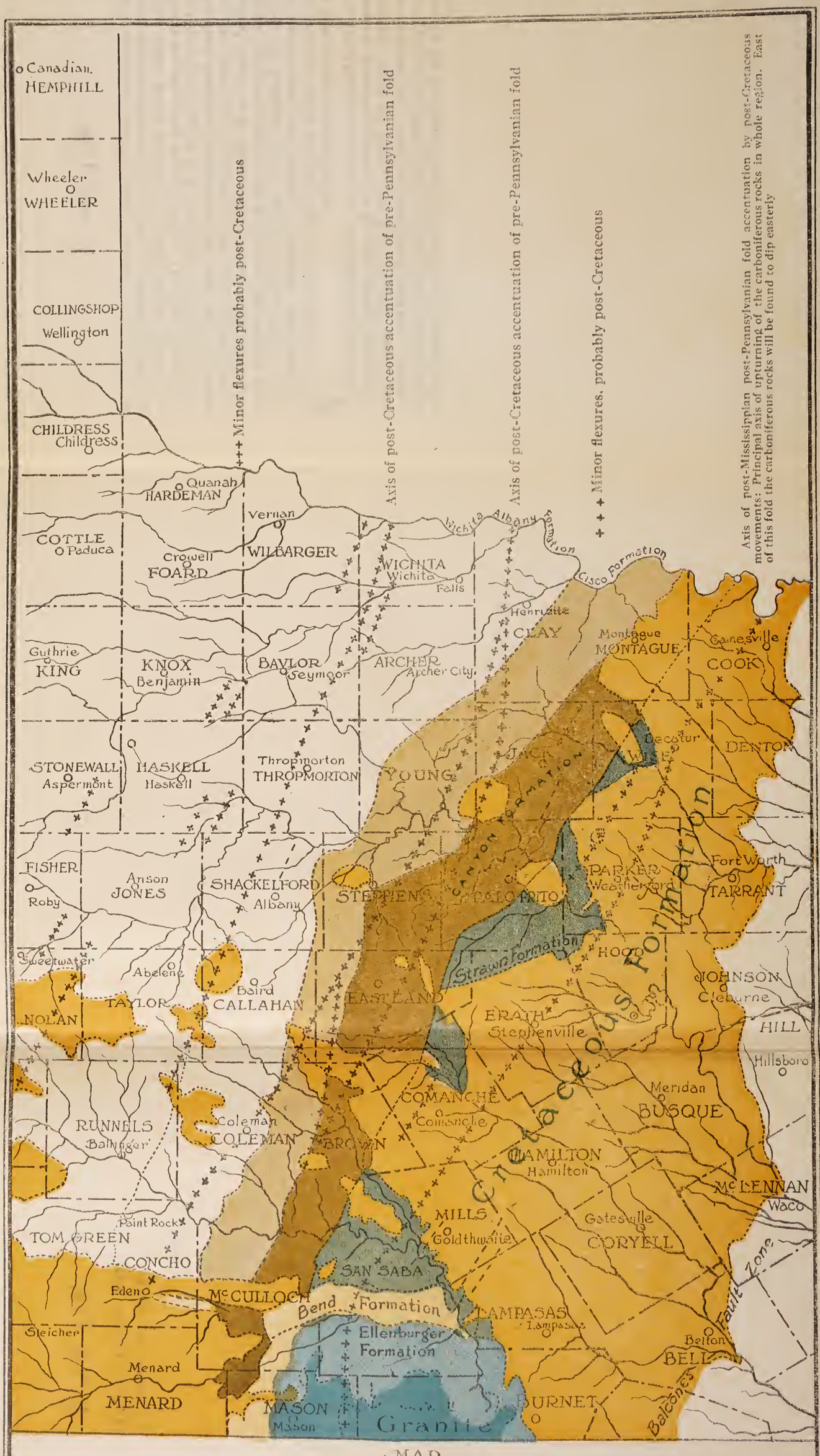
Frequently these surface indications clearly reveal the presence of an arch, and the crest of such arch may be plainly discernible in the surface rocks. The underlying oil-bearing rocks at such point are known to be the same as in an adjoining producing field. The question then is "Are the sands in the formation below such arch porous, or have the voids between the grains of sand been filled with lime brought down by percolating waters? The arch is there — plain as the Dome on St. Peter's Cathedral — the oil-bearing formation is there, proved by the drill in the adjoining field. If the sands beneath the oil bearing rocks are porous, this dome will be full of oil and salt water will be surrounding the edges of the dome and filling the slopes (monoclines) and synclinal troughs for miles around. (See Map 2 for illustration). But, if the sands are non-porous, the voids between the grains of sand filled solid with cement leached from the lime above — a solid block of impervious concrete — no oil will have accumulated and the dome will be barren structure.

To illustrate more clearly. The now famous Duke Field in the Northeastern portion of Comanche county in Texas (See Duke Well on Map 2) is no longer in question — it has been proved by the drill. Today there are many wells in that field producing vast amounts of oil, and the largest gas wells of the North Central Texas Fields are found there. This field is located on one dome of the Duke fold or arch. The

Map No. 3

The North-Central Texas Oil District covers an area practically 200 miles long and 100 miles wide. The various colors shown on this map define the surface area of the rocks of the different ages, which are as readable to the geologist as words in a book. The Cisco, Canyon, and Strawn formations (as marked on the map) pitch in a westerly direction, and the Bend formation (as marked on the map) near the Granite Uplift pitches north and produces from an arch to the east and northeast of Eastland (known as the Ranger Field) at from 3,200 to 4,000 feet, and further north they underlie the Burkburnett Oil Field at about 5,000 feet. The Burkburnett oil migrated up to within 1,700 feet of the surface from the lower rocks in which it originated. The Granite upheaval, which was forced up through each series of sedimentary rocks tilting them on end, is marked in blue.

The dotted lines traversing the area in a general northeasterly and southwesterly direction (as marked on the map) indicate the crests of the anticlinal folds of the district. The domes are producing oil or gas at their crest, and some of them are producing oil down their monoclinal slopes for miles each direction from the crest. This map was made a year ago and the development since then shows that it stands alone in accuracy.



· MAP ·

SHOWING MAJOR AREAL AND STRUCTURAL GEOLOGICAL FEATURES of NORTH CENTRAL TEXAS

Base Map and areal geology after State Map of UDDEN

drill has proved that this field extends westwardly in Comanche county. It is no longer a question whether this pool extends eastwardly from the Duke well and across the line into Erath county, the adjoining county. The well known as the Phoenix well on the extreme eastern edge of the Duke pool (See Map 2), the great Cosden gasser just along the line of Erath and Comanche counties, and the three square miles of intervening territory, show this much practically proven oil and gas territory of the Duke field extending eastwardly into Erath county. The question then arises "Has Erath county another distinct and separate pool in the fold or arch found east of the Duke fold? Does an oil pool lie in the lower rocks which, near the Erath-Comanche county line, plunge eastward in a monoclinal dip beneath the surface rocks of Erath county and rise again in an arch (anticline) in that county? Do the producing sands of the Ranger and Duke fields contain oil in the high or anticlinal structure of this second fold about eighteen miles farther east (See dotted line on Map 3) and which extends northeast and southwest through Erath county?"

This great arch is plainly discernable in the surface rocks near Stephenville in Erath county. Its crest — the key-stone of the arch — is eighteen miles east from the crest of the arch in the great Duke field. The underlying rocks are the same as those of Duke and Ranger. Here we have the arch the same as is shown at Duke, and this Stephenville arch is larger than the Duke arch. The question is "Is there oil in the Stephenville arch? Are the sands in the Bend formation, which underlie this Stephenville arch, porous, or have the voids between the grains of sand there been filled with lime brought down by percolating waters? Here we have the arch, and the underlying oil-bearing rocks are there. If the sand in the underlying Bend formation is porous it should be full of oil — a great pool of it — with gas on top, oil on the sides and salt water surrounding the edges of the dome and filling

the monoclines and synclinal troughs. (See Map 2). If, on the other hand, the sand is non-porous, the voids between the grains of sand filled solid with cement from the lime above — a solid block of impervious concrete — no oil will have accumulated; the dome will be barren structure. The drill will tell this. Its answer is awaited with deep and vital interest by scores of oil operators, hundreds of land owners and an eagerly expectant public. Drilling wells in that territory are now seeking the answer.

Thus it will be seen that it is not the province of the geologist to find gas and oil; it is rather his province to locate the structure and to keep his clients as far away as possible from places where there is little or no chance of finding them. On the dome is always the place to drill. The syncline never can yield oil, unless, perchance, there is no water in the structure which is a most rare condition. The syncline will be full of salt water and the oil will have floated on the water up to the higher places — to the domes.

When the first well in a district strikes oil, then the real expert — one who has studied and knows conditions obtaining there — can readily tell in what direction the field should extend and how far from the producing well in each direction it is safe to drill.

SHALLOW OIL POOLS

When these arches and domes, disclosed by surface indications or otherwise, have been located, there is always a chance that the lower strata from which the oil originated, cracked in its folding (See Map 4), in which event some or all of the oil accumulated in that dome of the arch in that strata, broke through and migrated to upper beds of non-porous rocks and thence to the arches and domes of that strata. Then, of course, the oil would be found at a shallower depth. This explains why oil is often found at a shallow depth in fields

where it is known the oil originated in rocks often thousands of feet below where it is found. This same condition may obtain in territory regarded as impossible to reach with the drill the rocks in which the oil originated, owing to the depth. The chances are about one time in a hundred that the rocks or limes holding the oil in its original sands cracked in their folding or arching and the oil there accumulated thus escaped and migrated to these upper beds.

Again, shallow oil pools are found as the result of what is known as "Faulting"— where the earth's strata, through pressure, break and their edges slip, one edge with an upward tendency and the other downward (See illustration on Map 4) In this Faulting often all or some of the oil of the oil-bearing strata will break through and rise, or migrate to upper impervious strata and thence to the arches and domes of that strata, as in the case of the cracking of strata in folding.

The drill in test wells often finds at a shallow depth what they call a "new sand," which is nothing more than the migration of the oil from its original rocks to these upper beds or strata.

Why take chances and drill territory like that in the hope that the oil has broken through, from some cause, and migrated up when there is so much undrilled territory where the oil-bearing rocks can be reached by the drill, such as the extensions of the Ranger field, the Duke field, and many other points in Texas which have not as yet been tested by the drill. Then, if the oil has broken through it can be found at a lesser depth, and if not it can be found where it belongs.

MAGNITUDE OF NORTH TEXAS DISTRICT

A great arch of Mississippian rocks, tilted up by the granite uplift of Llano, San Saba and Mason counties of Texas, plunging north 200 miles to the Red River and traversed from

end to end by small paralleling arches or folds on its slopes and crest, (as shown in Map 3), is the North-Central Texas oil district. There is no other known district showing an arch of Mississippian rocks (the rocks from which it is now established the oils of the district originated) the magnitude of this one, with one slope or monocline pitching to the Balcones Fault on the southeast and the other slope or monocline pitching to the staked plains of the Panhandle on the Northwest. It is unquestionably the largest discernible arch of oil-bearing rocks in the world yet discovered, and has drained up its vast monoclinal slopes an abundance of oil that will yet startle the world, which oil has naturally floated on water up into the domes of the many major folds that traverse this majestic arch from end to end.

The area comprising the North-Central Texas district is practically 200 miles long by 100 miles wide, yet not more than two per cent. of this vast area can possibly produce oil. Knowing this, the mystery to me is that capital, under the flush of excitement, has bought and paid good money for leases covering practically the entire district when 98 per cent. of it must inevitably prove non-productive.

In the great Pennsylvania district less than two-tenths of one per cent. of the oil area is productive. More than half of Wyoming's production is within a space of six square miles. The noted Tepetate-Casiano pool in Mexico, which has produced 75,000,000 barrels of oil in eight years, is only one mile wide and four miles long.

MINOR FOLDS OR "WARTS" MISLEADING

On the crest of this great arch and between the major folds there are sure to be slight folds, or what one might call "warts" in comparison of their importance with the larger

folds. Promiscuous prospectors are certain to drill into these "warts" and get a temporary flow of oil and gas. Then the unsophisticated ones will buzz around and pay fabulous prices for leases in that vicinity and the "old-time" oil man — the one who has always reckoned without science — will immediately begin to prove that geologists were wrong in condemning that particular territory.

HOW THE OIL GAME IS PLAYED

North Central Texas has a thousand wells now drilling in proven and prospective fields. The scope of the productive areas is still untested by the drill.

The oil promoter came, of course, along with the developer and producer, and played his game, the ONE SURE THING IN OIL; sure of its results both for promoter and investor — these SURE results are known. Discussion of his enterprise will be passed by to tell "HOW THE GAME IS PLAYED BY OIL MEN — developers and producers of oil.

The Prospector and Developer

Leases are obtained and the land owner receives one-eighth of the oil produced — his "Royalty." That is his share established by custom and experience. If his land is in a proven field his lease is worth a bonus — thousands of dollars per acre if close up to good wells, **but close up means close up.**

If the land is some distance from a proven field it is still worth money, if on good "structure," and still more if the "structure is being tested by the drill. If not on "structure" it is worthless even though it may be fairly near production. If not on "structure" it is worthless, absolutely so, notwithstanding the fact it may sell for real money to someone who knows no better than to buy it — and there are many such.

The operator takes the lease and drills the wells, produces at his own expense and pays the land owner his one-eighth royalty. Often the operator sells interests in his enterprise to one or many others, sharing expense and profits. Sometimes he incorporates.

When testing a new field if the operator is wise he takes his leases on a "structure," "dome" or "arch" and verifies his location by the best science, money and judgment can command. If he is rash, or still believes (as some men do) that oil may be found anywhere, he gets his leases where he can and starts the drill at random.

If well supplied with patience, nerve and cash, the operator, having found his "structure," "dome" or "arch" as it may be termed, leases the whole "structure" if he can — 10,000 acres or more perhaps — so that he will control a field if he discovers oil.

When he has leased his land and put aside the capital to drill the well, he finds that he is staking a fortune on the prospect of finding oil. The cost and expense of getting 10,000 acres of leases on "structure" fairly near a proven field and drilling a well 3,000 to 4,000 feet will run into over a hundred thousand dollars. This is a venture of some magnitude even for big capital, however good the structure. The operator does not hope to "own the earth;" he has other ventures and investments. He wants to "hedge" instead of carrying alone the burden of his venture. Others join him and take interests in the well. Other operators, individuals and the Producing Companies buy leases from him in his block around the well.

If his well gets oil a new pool is discovered and opened up, and it is here that the greatest profits are made in oil. Where the risk runs highest profits naturally run highest. Lease values will then run to a hundred times their cost.

Those who hold interests in the well are invariably old business associates and have their settled policy for handling

oil, have backed the project and will see it through whether he sells a lease or not.

He who buys a lease has it in his own control to sell or operate at will. No controlling interest can dictate a policy or say what profit the minority shall take. No promoter's organizing expense and profit need be paid. No corporation law hampers his business. He has bought the lease and it is his. The money he has paid goes mainly to help drill the well to test the district and to prove the value of his lease.

If oil is found he may cash in and take his profit by selling at the enormous price leases bring in proven fields, or he himself can operate or get his lease developed by oil men, he still retaining for himself the lion's share.

If he has bought "royalty" from the land owner he owns what oil men term the "Gold Bond" of the business. He takes his share of all the oil produced and the operator has all the trouble, worry and expense of producing the oil.

If the well drilled proves a dry hole and the territory is thus condemned, he has lost his money on a chance to win. He has had a square deal, for no one has been in a position to take advantage or defraud. He has played the game the oil man's way. He has had a run for his money — win or lose — and has done his part to help supply the Nation's need of oil.

That is "How the Game is Played" in the exploitation and development of new fields.

The Producers Game

There is another branch of the oil business, and a vastly more conservative branch — one in which fortunes are made, though not so fabulous as in the exploitation and development of new fields, since with the elimination of **risk** profits

are proportionately reduced. This branch is the purchase of production in proven fields. This, however, is the realm of organized large capital and the Producing and Refining Companies of large capital, and is quite beyond the reach of the man of small capital, since prices are enormous. Here the expert is needed to conserve the interests of the purchasers, to determine whether the production is near salt-water or high up on the structure, and through the expert the value of the production is fixed.

The man of small capital desiring to make investments in oil, will ask "Is there no way in which I may invest my money in a safe and conservative manner.?" Yes. The man of small capital has no better and more profitable means of making money — big money — than to interest his business associates and friends with capital in pooling their money — forming a syndicate — thus having at all times a large amount of money available to take advantage of the many opportunities offered in leases close to production in a proven field. When the first well strikes the oil sands in any new district, there is a period of several days in which opportunities are presented for buying at nominal prices — indeed at bargains — leases close up to the well. With a sufficient amount of cash on hand to take advantage of these bargains, large profits can be earned by the members of the syndicate, in which they share proportionately.

In order to safe-guard the interests of these investors such leases must be carefully selected by an expert. To pay big money for a lease in the wrong direction from a producing well, and off the structure, means not only the loss of the money paid for such lease but also the loss of the profits that would have been made from the investments where leases are carefully selected. The well opening up any new district may be on what is called the rim — the edge — of the pool underlying the district on one side or the other, and the location of the oil pool from the well means everything to the lease

buyer. Here again is the function of the expert, for only the expert can determine and define the extent and direction of the pool and tell just how far away from the well in each direction it is safe to purchase a lease — one of value — or to drill a well.

Promoter's Game

In the organization and promotion of oil companies, which have not had proper guidance in the selection of their leases, the greatest abuses of the rights of the investor are found. It is a well known fact that great numbers of the oil companies organized and promoted — and whose organizers, officers and directors are unquestionable so far as financial and business reputation is concerned, — prove failures and a consequent loss to the purchasers of their stocks. In fact there have been so many of these failures and so great has been the loss to investors, that the man with any capital to invest has almost lost faith in the purchase of oil stocks. These failures are attributable to various causes, but the most frequent cause is that the company was organized and its capital stock, or at least a very large part of it, was paid in by the transfer of its lease holdings put in at inflated prices, and the whole scheme is promoted on leases selected at random without regard to location or underlying structure, and from which there never was a chance to produce a barrel of oil.

No business can be greater than its management, and no oil company's value can possibly be greater than the value of its lease-holdings.

The leases of these oil companies in most instances have been bought up by some one who knew nothing of the oil business, but who went out when the oil excitement started in some portion of the State and bought leases from land owners wherever he could, without having any knowledge

whatever of either the surface or underlying structure of the lands or the possibilities of an oil yield therefrom.

Take the State of Texas, for example, where the oil excitement is now most rife: Because there is oil under some portions of the state does not at all indicate that there is oil to be found under every portion of it. The state of Texas is large — larger than the whole of Germany. To say that a lease is in Texas, or even in the North Central Texas District, does not at all signify that it is in the oil yielding area. **Again I say that not two per cent of the vast area comprising the North-Central Texas District can possibly produce oil.**

These oil companies when organized sell their stock to the investing public — usually to men with small capital to invest — through glaring advertisements and smooth-talking unscrupulous salesmen, and with the money thus obtained they drill their well or wells on their leases, which wells are inevitably dry holes. Then they are broke, and the purchasers of the stock have paid the expense of the venture and are the losers — losers not only of the capital invested but likewise of the profits that would and could have been realized on the investment had the leases of the company been carefully and properly selected by an expert in a proven field or even possible territory. Had the leases been properly selected such company could and would have made money for the organizers and promoters of it and paid handsome dividends to the stock-holders.

There are many such companies today offering their stock for sale to the public, and it behooves the investor to know and not guess about them before placing his money. There are just as many conservative companies — companies who have in all good faith and conscience gone out and paid their money for expert advice in the selection of their holdings on which to drill; the very best science and skill money could

command — whose holdings are within well defined oil-producing areas and worth good money whether they drill their wells or sublease to some producing company who will drill for them. The purchasers of their stock have bought an interest in something of value.

For one having actual knowledge of the oil areas of any field, it is an easy matter to readily determine the value of the stock or properties of any company. All that is required to determine this is a statement of the capitalization and a description of the holdings of the company.

DEMAND FOR DEVELOPMENT

Few persons realize what unceasing effort is necessary to secure a sufficient supply of crude oil in this country. The decrease of oil production and the rapid increase of demand compel the expenditure of large sums in prospecting new territory.

In 1917 the world approached its crisis. The war was on. America had been asleep but awoke to find the World's fate in Her hands.

The Allies' Battle Fleets burned oil. The battle tanks, the cannon's motor lorries, the ammunition trucks, the Red Cross vans, the war craft of the air, the cars for officers and men, the million cars and trucks behind the lines in France, in Belgium, in England and America, burned fuel made from oil.

It was the Age of Oil. Oil or its lack might mean a victory or defeat. Oil would be one great factor when it came to Terms of Peace.

The Hun controlled Roumania's ruined fields. Baku was held by the Bolshevik, whose master was the Kaiser. The wiley German agent connived and schemed in Mexico to stop the flow of oil.

Development in the new fields of Persia stopped. Shipping was short and Burma's output was diminished. Samatra and Borneo were far away and their production declining. Japan's small fields could not supply the home demand. China as an oil proposition had proved a failure.

In Central and South America no important fields had been developed.

In Oklahoma, Cushing field was on the rapid decline and the other fields were scarcely holding their own. Production in Kansas had reached its zenith and was falling off. The fields of fuel oil in Southern Texas showed no substantial increase.

In California and Wyoming the important oil deposits were set aside for future generations under the plea of Conservation. Development in many districts stopped, pending the outcome of Government litigation. Consumption far outran production. Supplies of oil were falling off throughout the world. The question loomed "WHAT SHALL WE DO FOR OIL?"

Efforts were made to win over the Bolshevik; the Nations begged Carranza to be good; the older fields of the Mid-Continent were redrilled and every promising structure tested.

In Wyoming and California development on private lands was pushed to the utmost. Oil men went to Washington and urged the opening of the Western Oil Reserves, but Conservation held its own. Washington recommended the distillation of shale, but the process was costly and difficult, and the yield small in comparison.

A few tests of the Mississippian (the formation underlying the Pennsylvanian measures of Kansas and Oklahoma) had proved futile. Theoretical geologists looked sad and said "No oil is in or under the Mississippi Lime in Texas."

In North Texas a few small pools were found in Pennsylvanian rocks. What tests had reached the Mississippi Lime (reached but not probed) without finding oil were pronounced failures and abandoned.

But suveys by trained geologists (of my staff operating in, Texas in 1913–1914) three years before had found the Mississippi Lime outcropping near the Granite Uplift in Mason and San Saba counties charged with oil at the surface.

The strata of the Mississippian, termed the **Bend**, sloped to the north beneath the overlying Pennsylvanian rocks which plunged off at right angles to the west.

Their verdict was that the Mississippian rocks, till then pronounced barren, would prove, as they have since so bountifully done, to be the source of oil in Texas as in the states of Pennsylvania, West Virginia, Kentucky, Illinois, Kansas and Oklahoma.

Their conclusions were verified. Discovery of oil in these Mississippian rocks in fabulously rich pools startled the World. The North Central Texas District has become the greatest oil area on earth today.

The World Crisis was met. Never was necessity of a nation — or in truth a great world need — more bountifully supplied at a more crucial time, and with such a magnificent product! — A high-grade refining oil equal in every way to the Pennsylvania crude, the world's finest.

The world was ready for the discovery. Oil men from every field came in.

SELECTION OF LAND MOST VITAL

There are thousands of oil producers in the United States, and many are today operating in the North-Central Texas District. In view of the keen competition for land and the

increasing cost of drilling, careful selection of oil-land holdings is most vital. The Geologist, therefore, cannot safely be ignored. In Oklahoma, for example, geological investigations are credited with bringing in many new pools, and the proportion of dry holes on territory recommended by geologists is less than one third as great as before the scientists took a hand in the game.

The most nauseating thing in the world to me is the "old time" or the "new time" oil man who took a lease in a district because some real gambler or man of exceptional brain power figured it out as the right place to drill a test well, and this "old time" or "new time" oil man eventually strikes oil on his lease — through "fool's luck" he had chosen the right direction from the producing well, he knew not why — He immediately buys a diamond as big as the sun in comparison with his brain, announces himself as an OIL EXPERT and recommends the drilling of test wells in a new district, his arguments for the district being none other than that it looks good to him; that he has been in the oil business many years, or that he is a producer of oil and naturally **knows all about it.** With this line of argument he creates an atmosphere the layman is unable to penetrate and innocent people, solely on their confidence in him, invest and lose their all. In this he is guilty of two moral crimes. He has caused innocent people to invest and lose their all, and has destroyed their faith in the legitimate oil business.

All men who pose as geologists are not geologists. Geologists are just as human as the men of the legal and medical professions, and there are just as many inferior ones among them as every one knows there are in the other professions, and it behooves the business man to handle them and get from each one the thing of value he really has to deliver. In other words, penetrate his pose, as all professional men with whom I have had experience, pose to the layman.

I wish to say here, as I have said many times in the public press, **I am not a geologist.** I have, however, studied the subject of geology for many years, and have mixed socially, in business and in physical combat, have discussed the subject of geology many many nights around the camp fire, and slept on the ground for weeks at a time with some of the most eminent geologists of the world, and from my experience with them I know whom to employ from among the profession, how long to employ each one at a particular kind of work for which he is best adapted; I know where to look for their mistakes and how to check them up.

I have paid the price, by not coming into my own, of many millions through errors of geologists in turning down good oil land and in recommending lands from which there was not a chance to produce oil. I have since learned, in my years of experience, that many of those mistakes could easily have been avoided had I had my geologists work **with me instead of for me trying to run my business their way.**

I am not trying to leave the impression that I know all about the oil business, because it is a vast subject — too vast for one human mind to fathom. I have had years of experience in the oil business, and in many fields. I have made many mistakes that caused me years of sorrow and worry. I am merely trying to protect, as far as possible, the investing public from making those same mistakes, as it is not likely that one of ordinary intelligence will make the same mistakes over and over again.

With my experience, I do not believe one will ever be able to accuse me of reckoning without Science in the oil business, or drilling into a "wart" for oil, which is the destiny of so many men in the business at this time whose conceit will not allow them to be told anything new.

July 1*st*, 1919.

Anticlinal Fold, Chesapeake and Ohio Canal, near Hancock, West Virginia

(From Photograph)

Above plate from THE NEW INTERNATIONAL ENCYCLOPAEDIA
Dodd, Mead & Company, Publishers